LESSON 2A—NARRATIVE: WHAT IS THE EARTH'S ANCIENT ORIGIN?

Our ancient earth is more than four billion years old.

You must know something about past time in order to understand how archaeologists study the ancient people of the **New World.** The New World is our land in the Western Hemisphere. The past includes your family's arrival in Montana, Montana's beginnings as a state, and even our country's start—but past time goes much further back than that. Travel to the past time when explorers from the **Old World** of the Eastern Hemisphere—Europe, Asia, and Africa—arrived in North America. Continue further back to learn about former Old World civilizations like Rome, Greece, and Egypt. You can study past events through research in written materials. This is known as the study of history. A great amount of written material describes our world's history. Our history appears to cover a large amount of time. But actually, the portion of time that involves humans on Earth is extremely small.

Travel even further back in time, to thousands and thousands of years ago, before the existence of writing. This is known as prehistoric time. No written records exist to study prehistoric time, but you can still study it by researching artifacts, ecofacts, and features. These items provide clues that allow archaeologists to develop theories, or ideas, of early human life, as we've already discussed in Lesson 1A.

Now, travel even further back in time, millions and millions of years. Scientists in other fields besides archaeology study the past before human prehistory. Some scientists gain knowledge of the earth's **origins**, or beginnings, by studying the earth's rocks and strata. This study is known as **geology**. Other scientists study **fossils**, the hardened remains of very ancient plant and animal life found in geological formations. The study of fossils is known as **paleontology**. Many of the techniques used by geologists and paleontologists are similar to those used by archaeologists.

Long before humans appeared, a vast array of other life forms roamed the earth's ancient land and seas. Environmental conditions changed radically through those millions of years. Deserts stood where forests now grow. Great inland seas and steamy swamps covered landscapes that we now know as plains. During some periods, intense cold surrounded our planet, while during others, the earth experienced severe heat. Dramatic shifts in climate and weather led to changes in habitat, or the places where plants and animals normally live. **Flora** and **fauna**, or plants and animals, adapted to the changing conditions when they could. If the struggle to exist was too great, they became **extinct**, or disappeared completely, while other plants and animals were able to survive.True extinction is a natural event that happens when ecological conditions collapse. The transformation, or change, in living organisms over time as they struggle to adapt is known as **evolution**. As scientists study Earth's evolution, they gather information about the past.

Geologists study rocks and strata so that they can understand the earth's story in time. They search for clues in three types of rock: **sedimentary** rock, **igneous** rock, and **metamorphic** rock. Sedimentary rock originates when sand, soil, and silt settle to the bottom of bodies of water. Layers of sediment accumulate through time. Thousands of years pass as the sediment hardens into sedimentary rock. Igneous rock has its origins deep inside the earth. It begins as **magma**, or hot and molten rock. Internal pressures force magma through cracks and fissures until it reaches the earth's surface, sometimes violently in the form of an erupting volcano. Once at the surface, magma cools and hardens into igneous rock. Metamorphic rock is rock that was once igneous or sedimentary rock. Great pressure and heat, over long periods of time, cause changes in the rock's mineral content, and it transforms into metamorphic rock. Like archaeologists, geologists study the strata of the earth's crust to determine the **chronology,** or order in time, in which geological events happened. The **geologic time scale** represents this order of events.

You can see significant changes in life forms in the geologic record. Paleontologists are interested in the fossils preserved in sedimentary rock. A fossil was once a living organism that is buried in layers of sediment. If it was an animal, its flesh rotted, leaving behind bones and teeth. Soil, silt, and sand buried the remains. Over thousands of years, the remains of the living organism hardened into rock. This fossil record of prehistoric plants and animals helps us understand evolution. Paleontologists identify the fossil record according to geological time.

As scientists conduct research, they create theories about earth's evolution. One theory believed by many is **continental drift**. The continental drift theory explains the huge changes that the earth's surface has undergone. Before the continents had their present locations, the theory states, one giant supercontinent connected all land. This supercontinent, **Pangaea**, existed over 200 million years ago. Pangaea was made up of ancient deserts, tropical swamps, mountain ranges, forests, and scrub lands. A universal ocean, **Panthalassa**, surrounded the land. The memory of this past is preserved in the fossil record. Paleontologists today find identical fossils on separate continents. Pangaea and Panthalassa are Greek words meaning "all land" and "all sea". Other combinations of land masses and oceans existed before Pangaea and Panthalassa.

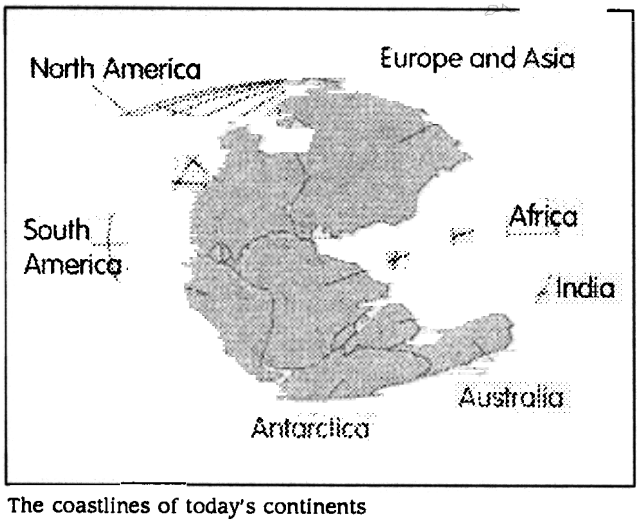
According to paleontological research and theory, primitive life began on our planet more than two billion years ago! This early life was a single-celled, microscopic bacterium in ancient seas. Earth's original atmosphere lacked the oxygen levels necessary for life to exist on land. Millions and millions of years went by as additional life forms evolved. Oxygen levels increased as the first plants developed **photosynthesis**, the ability to use the sun's energy to create food for themselves. A layer of ozone built up in the atmosphere and protected life forms from the sun's rays. Soft-bodied **invertebrate** animals began to develop in

water. Millions more years went by as life continued to evolve. Animals with hard outer **exoskeletons** appeared. Marine, or ocean water, life expanded tremendously. Millions of years later, **vertebrates,** or animals with a backbone, emerged. Primitive fish were the first vertebrates. Environmental changes continued as life forms evolved.

Millions more years passed as plant life advanced from water to land. The oxygen in the atmosphere increased and created a more suitable environment for land life. Dense vegetation on land developed, followed by the first **amphibians**, animals able to subsist both in water and on land. Temperatures warmed, and the land dried. **Reptiles**—vertebrate, air-breathing animals covered with scales that crawl on short legs or their bellies—evolved. Geologists and paleontologists believe the supercontinent of Pangaea formed as reptiles emerged from the sea. This theory explains why the same fossils have been discovered on our separate continents. The most famous reptiles, known as dinosaurs, ruled for millions and millions of years. Tiny **mammals**—hairy, warm-blooded animals that feed their young with milk produced in mammary glands—competed to survive alongside the dinosaurs. The extinction of these ancient reptiles allowed mammals to continue to evolve. Millions more years passed. Then, just a mere two or three million years ago, the first humans appeared. Their existence is preserved in the fossil record.

There are many other theories about the origins of the earth and of life on earth. Scientists continually debate the various theories that attempt to explain the very early past and our origins. Future developments, discoveries, and research may lead to new ideas. Current theories may be proven wrong. The ideas we have presented here represent those that seem most likely at the present time.

An archaeologist must be aware of other fields of study in order to conduct archaeological work. This knowledge helps the archaeologist understand the earth's evolution and learn the place of human existence within that evolution.



The coastlines of today's continents are evidence that they were once connected as a "supercontinent" known as Pangaea.

Lesson 2A—Vocabulary: What Is the Earth's Ancient Origin?

amphibian

astronomy

Big Bang

chronological

continental crust

continental drift

core

evolution

exoskeleton

extinct

fauna

flora

fossils

geologic time scale

geology

igneous

invertebrate

magma _____

mammal _____

mantle _____

metamorphic _____

New World _____

oceanic crust _____

Old World _____

origins _____

paleontology _____

Pangaea _____

Panthalassa _____

photosynthesis _____

plate tectonics _____

reptile _____

sedimentary _____

vertebrate _____

LESSON 2A—ARCH ACTIVITY: CONTINENT CONNECTION

Grades: 3–8
Time: 40 minutes
Content Area: science, geography, writing, and art
Who: individuals and pairs

Materials:
- **world maps and tracing paper for each pair**
- **thin cardboard**
- **scissors**
- **glue**
- **large blue construction paper**
- **Arch Journal**

OBJECTIVE AND OUTCOME

•Students will understand the theory of plate tectonics and the earth's movement.

•Students will create a world map of the ancient supercontinent (Pangaea) and write about plate tectonics.

ACTIVITY

1. Inform students they will create Pangaea, the ancient supercontinent. Assign students to work in pairs.

2. Each pair needs a world map and tracing paper. Instruct students to trace the general outline of each continent. Then turn tracing paper over and trace over the outlines with a soft pencil. Discuss continents and their current locations.

3. Turn the tracing paper back over, place on cardboard, and draw the lines. Carefully cut out the shapes. Instruct students to fit the continents together, like a jigsaw puzzle, to form the supercontinent, Pangaea, before the continents drifted apart. Make sure the cardboard continents are facing in the right direction. Glue the assembled pieces on the blue construction paper, which represents the sea.

4. Discuss the changes in the locations of the continents through time. Locate a map of continental drift locations and create overheads to show students. Instruct students to write a paragraph in their Arch Journal describing those changes.

EXTENSIONS

3–8:

- Research vocabulary.

See: Lesson 2A—Vocabulary

- Create possible supercontinents of the future.

LESSON 2A—ARCH ACTIVITY: WHEELING THROUGH TIME

Grades: 3–8
Time: 30 minutes
Content Area: science and writing
Who: individual

Materials:
- **blank time wheel (one for each student)**
- **completed time wheel (one for each student)**
- **colored pencils**
- **Arch Journals**

OBJECTIVE AND OUTCOME

•Students will gain an understanding of time past since the earth's beginnings.

•Students will create personal time wheels for the geologic eras, compare theirs with the geologic time wheel, and write sentences about the differences and similarities they discover.

ACTIVITY

1. Discuss the geologic past in terms of eras. These eras are named the Precambrian, Paleozoic, Mesozoic, and Cenozoic. List these on the board without reference to time.

2. Hand out a blank time wheel to each student. Instruct each to divide his or her wheel into pie-like sections indicating the length of each era. Use 12 o'clock for the beginning. Instruct students to color and label each section with the name and amount of time they believe is represented. Hint to them to use millions and billions of years.

3. Have students share their wheels and interpretation of time. Determine which eras they believe are the longest and the shortest.

4. Hand out geologic time wheels with the correct time periods.* Compare the students' ideas with those of geologists. Discuss how much of what we are familiar with (including dinosaurs) is very recent in geologic time. Have the students write these comparisons in their Arch Journals.

EXTENSIONS

3–5:

- Research vocabulary.

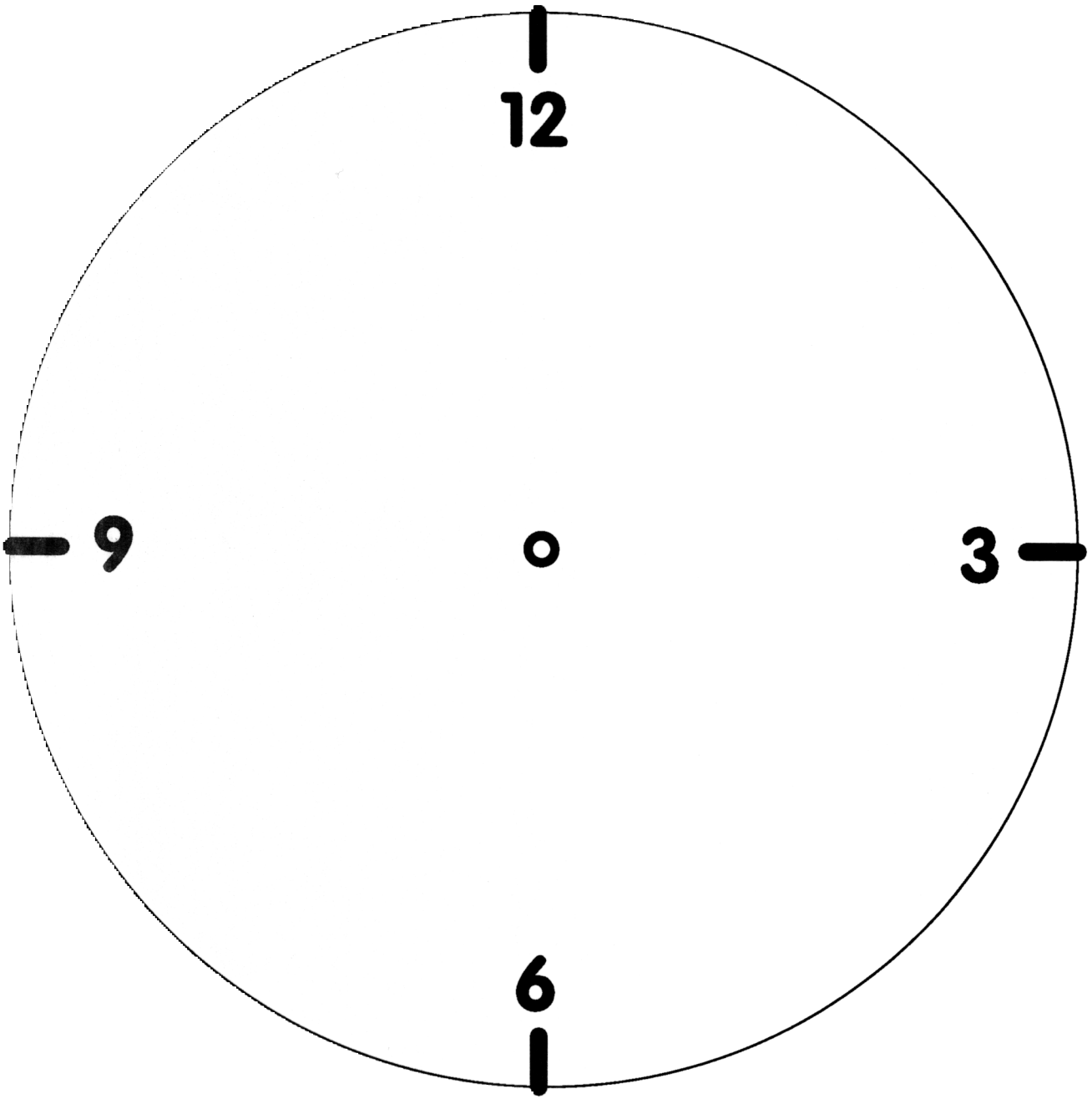
See Lesson 2A—Vocabulary

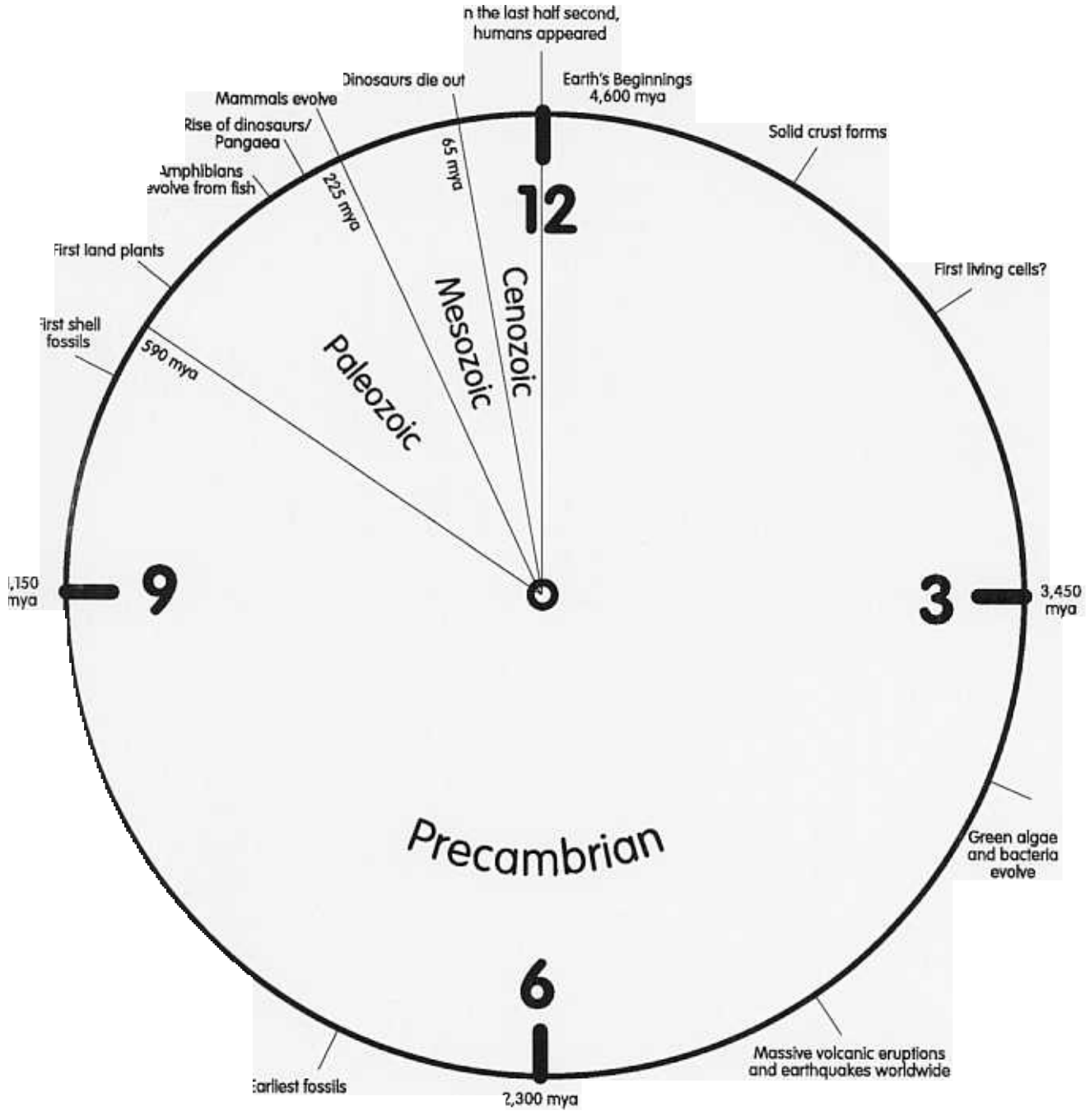
3–8:

- Locate and study other geologic time scales. Write reports on periods and epochs in an era. Research life in each.

** Precambrian—Age of Invertebrates (4.6 billion–590 million years ago); Paleozoic—Age of Fish and Amphibians (590 million–225 million years ago); Mesozoic—Age of Dinosaurs (225 million–65 million years ago); and Cenozoic—Age of Mammals (65 million years ago–present).*

LESSON 2A—ARCH ACTIVITY: WHEELING THROUGH TIME





mya = million years ago

LESSON 2A—ARCH ACTIVITY: FOSSIL IMPRINTS

Grades: 3–8
Time: 40 min., overnight, and 40 min.
Content Area: science, writing, and arts
Who: individual

Materials:

- **modeling clay**
- **plaster of Paris**
- **seashells and/or solid pine cones**
- **paint and paintbrushes**
- **petroleum jelly**
- **Arch Journal**

OBJECTIVES AND OUTCOMES

•Students will learn that a fossil is a past lifeform.

•Students will create a fossil imprint and write a story of its past.

ACTIVITY

1. Each student needs a shell or a solid (unopened) pine cone, or students may share objects. Instruct students to roll out a layer of clay, large enough for their object to fit onto.

2. Brush petroleum jelly on the object to prevent it from sticking to the clay. Press the object into the clay so that it leaves a clear imprint.

3. Mix plaster of Paris in a clean container, according to directions. Carefully pour the mixture into the clay imprint of the object. Do not overfill.

4. Allow the mixture to set and harden overnight.

5. The next day, peel off the clay. Paint the newly formed fossil.

6. Assign students to write a paragraph describing the object's journey as it became a fossil. Assign particulars if needed: geologic era, sediments, location, etc.

EXTENSIONS

3–8:

- Research vocabulary.

See: Lesson 2A—Vocabulary

- View a fossil collection.
- Research fossil discoveries in your locale, and throughout the world.